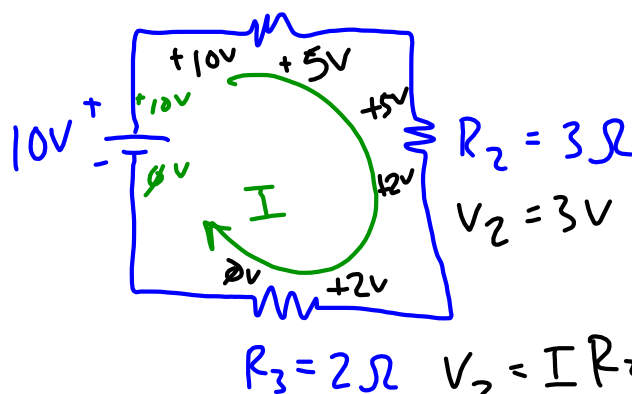


Circuits Continued:

• Series Circuits:

- Current is the same in all parts
- Resistors reduce voltage; batteries "produce" voltage

• Example:



$$V = IR$$

$$I = \frac{V}{R_{\text{Total}}}$$

$$= \frac{10V}{10\Omega}$$

$$R_{\text{Total}} = R_1 + R_2 + R_3$$

$$= 5\Omega + 3\Omega + 2\Omega$$

$$= 10\Omega$$

Voltage for R_1

$$V_1 = IR_1$$

$$= (1A)(5\Omega)$$

$$= 5V$$

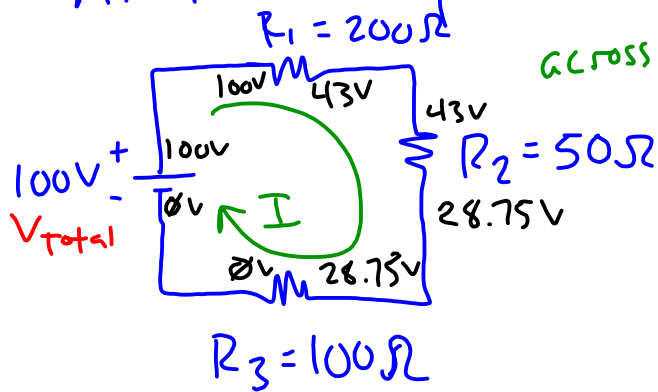
Voltage for R_2

$$V_2 = IR_2$$

$$= (1A)(3\Omega)$$

$$= 3V$$

- Another Example: Find I , voltages across each resistor



$$\begin{aligned}
 R_{Total} &= R_1 + R_2 + R_3 \\
 &= 200\Omega + 100\Omega + 50\Omega \\
 &= 350\Omega
 \end{aligned}$$

$$V_{total} = I R_{Total}$$

$$I = \frac{V_{total}}{R_{Total}} = \frac{100V}{350\Omega} = 0.285A$$

$$\begin{aligned}
 V_1 &= I R_1 \\
 &= (.285A)(200\Omega) \\
 &= 57V
 \end{aligned}$$

$$\begin{aligned}
 V_2 &= I R_2 \\
 &= (.285A)(50\Omega) \\
 &= 14.25V
 \end{aligned}$$

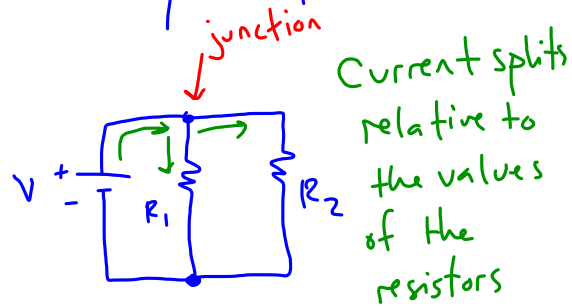
$$\begin{aligned}
 V_3 &= I R_3 \\
 &= (.285)(100\Omega) \\
 &= 28.5V
 \end{aligned}$$

- Parallel Circuits:

- There is more than one pathway for electrons to follow

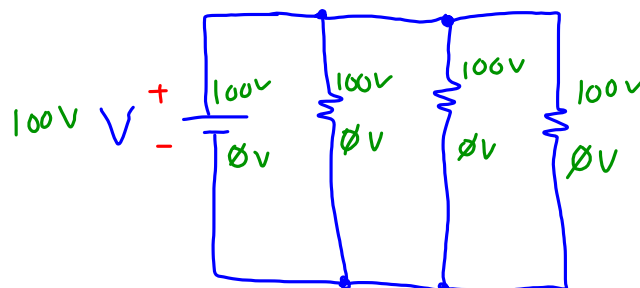
- We call these pathways "branches"

- Picture:



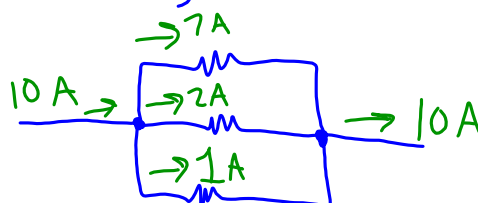
- When one part of parallel circuit is disconnected, rest of circuit still works

- Voltage is the SAME in each branch

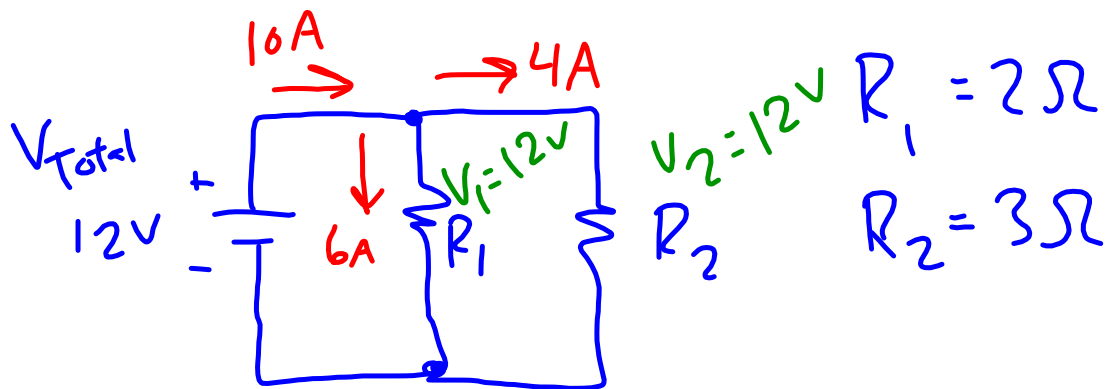


- Current can be different in each branch

- Current going into a junction must be the same as the current leaving



- Another another example:
 - Draw a parallel circuit with 2Ω and 3Ω resistors (each on one branch) with 12 V battery



$$V_{\text{Total}} = I_1 R_1$$

$$\begin{aligned} I_1 &= \frac{V_{\text{Total}}}{R_1} \\ &= \frac{12\text{ V}}{2\Omega} \\ &= 6\text{ A} \end{aligned}$$

$$V_{\text{Total}} = I_2 R_2$$

$$\begin{aligned} I_2 &= \frac{V_{\text{Total}}}{R_2} \\ &= \frac{12\text{ V}}{3\Omega} \\ &= 4\text{ A} \end{aligned}$$

- Safety
 - When many things are added to a circuit, the overall resistance is lowered.
 - This causes more current, which increases the risk of fire
 - Fuse \rightarrow wire ribbon that melts if current is too high
 - Fuses and circuit breakers open the circuit to prevent damage to anything attached
 - Circuit breaker \rightarrow essentially a magnetic switch that will turn "off" when current is too high